While the work is an excellent anatomical study of the fungus and its relation to the host, it contains little to elucidate the life-history of the fungus in nature, which, as the author remarks in the first chapter, is the only basis upon which defense is possible.—H. HASSELBRING.

MINOR NOTICES.

THE ACCOUNT of *Eucalyptus obliqua* L'Her., which is figured on four plates, forms part II of Maiden's *Critical revision of the genus Eucalyptus*. —C. R. B.

ENGELMANN has recently published the fifth fascicle of Dalla Torre and Harms's *Genera Siphonogamarum*,[4] including genera numbered 5183 to 6491.—C. R. B.

VOLUME 3 of the botanical series of the Field Columbian Museum is to be wholly devoted to *Plantae Yucatanae* by Dr. C. F. Millspaugh.[5] Dr. Millspaugh has been studying the plants of the insular, coastal, and plains regions of Yucatan for several years and has collected personally in this region. He has now begun the enumeration of the flora of the Antillean portion of Yucatan, which may be described as embracing roughly the portion of the state of Yucatan lying north of latitude 19° 30′. Fascicles will appear from time to time, as opportunity permits, without regard to the natural sequence of the orders, though they will be complete as far as the knowledge of the species permits. As a basis for the most important specific distinctions Dr. Millspaugh has selected the fruits and seeds, believing that these vary less than any others. Each species is illustrated by an inset figure, somewhat after the manner of Britton and Brown's *Illustrated flora*. These figures are admirably drawn by the author or by Miss Agnes Chase; unfortunately many of them have been sadly marred in the printing. If the copy which has reached us is a fair sample, we can only express surprise that the Museum should accept and issue such press work. It is extremely unfortunate that the excellent work of the author should be sent out in so unworthy a dress.—C. R. B.

NOTES FOR STUDENTS.

G. K. LEMMON describes in an out of the way place[6] a new lily, *Lilium Kelleyanum*, found near King's river, California, of which we make note that it may not escape attention.—C. R. B.

[4] DALLA TORRE, C. G., and HARMS, H., Genera Siphonogamarum ad systema Englerianum conscripta. Fasc. 5. pp. 321–400. Leipzig: Wilhelm Engelmann, 1903. *M.* 4.

[5] MILLSPAUGH, C. F., Plantae Yucatanae: plants of the insular, coastal and plain regions of the Peninsula of Yucatan, Mexico. Field Columbian Museum, Bot. Ser. 3: 1–84. Illustrated. 1903.

[6] Sierra Club Bulletin 4: 9. 1903.

KARL RUDOLPH has investigated the development of the spines of *Opuntia missouriensis*[7] and finds them purely epidermal and axillary outgrowths, not at all homologous with leaves or branches.—C. R. B.

LUTZ, after experimenting with certain fungi, suggests[8] that alkaloids in plants may be utilizable as plastic material when there is present an adequate supply of nitrates. So also a plant needs carbohydrates in excess before it can utilize asparagin. Lutz directs attention to the fact that certain plants (*e. g.*, aconite and belladonna) are rich in alkaloids when they grow in poor soil, but poor in alkaloids when cultivated in gardens, or when found in a soil rich in nitrates.—C. R. B.

MESSRS. SEWARD AND ARBER have critically examined a number of palm seeds from the Lower Tertiary of Belgium, England, France, and Italy.[9] The conclusion is reached, that they all belong to a single extinct species, *Nipadites Burtini* Brong. It is interesting, that at the present time a monotypic genus, *Nipa fruticans*, prevails in the Sunderbunds and in other southern Asiatic and Malayan deltas. The authors are of the opinion that the presence of *Nipadites Burtini*, together with other tropical forms of vegetation, in the early Tertiary beds of Europe make it extremely probable that a very much warmer climate prevailed at that epoch, than is now found in the same regions.—E. C. JEFFREY.

BENECKE, in an investigation of the formation of oxalic acid in green plants,[10] finds that maize plants form oxalates or not according as he supplies bases for combining with the oxalic acid. If nitrates be supplied, oxalate is produced; if ammonia salts (*e. g.*, sulfate) be used, no oxalate is formed. In other plants (Oplismenus, Fagopyrum, Tradescantia) he only succeeded in modifying the amount of oxalate by the culture conditions. The formation of raphides by Tradescantia was independent of external influences and could only be affected by the supply of calcium. In algae (Vaucheria, Spirogyra) no such relation could be determined. A useful summary of physiological literature of oxalic acid is given.—C. R. B.

HABITUAL POLYEMBRYONY in *Euphorbia dulcis* Jacq. (*purpurata* Thuill.) was described in a preliminary announcement[11] about a year ago. The full paper,[12] with figures, confirms the previous observations. The more extended

[7] RUDOLPH, KARL, Beitrag zur Kenntniss der Stachelbildung bei Cactaceen. Oesterr. Bot. Zeits. **53**: 105–109. *pl. 1.* 1903.

[8] LUTZ, L., Sur le rôle des alcaloids envisagés comme source d'azote pour les végétaux. Bull. Bot. Soc. France **50**: 118–128. 1903.

[9] SEWARD, A. C., and ARBER, E. A. N., Les Nipadites des couches Eocènes de la Belgique. Mém. Musée Roy. d'Hist. Nat. Belgique **2**:—. 1902.

[10] BENECKE, WILHELM, Ueber Oxalsäurebildung in grünen Pflanzen. Bot. Zeit. **61**[1]: 79–110. 1903.

[11] See BOT. GAZ. **34**: 153. 1902.

[12] HEGELMAIER, F., Zur Kenntniss der Polyembryonie von *Euphorbia dulcis* Jacq. (*purpurata* Thuill.). Ber. Deutsch. Bot. Gesell. **21**: 6–19. *pl. 2.* 1903.

investigations show that about three-fourths of the ovules contain more than one embryo. A considerable percentage of the pollen is sterile and fertilization was not actually observed, although it probably occurs in many cases. Pollination is not necessary for the production of adventitious embryos, at least not for those coming from the nucellus. Whether an embryo would develop from an egg of Euphorbia without fertilization was not determined. Professor Hegelmaier withdraws his earlier statement that polyembryony, as found in Euphorbia, might lead to apogamy.— CHARLES J. CHAMBERLAIN.

IRREGULAR MITOSES in pollen mother-cells and the consequent formation of imperfect pollen have already been noted in several sterile hybrids. In *Cytisus Adami*[13] a hybrid between *Cytisus Laburnum* L. and *C. purpureus* Scop., the development of the pollen is regular, but abnormalities which result in sterility are found in the ovule. After the integuments are quite well developed, a region at the base of the nucellus, rich in protoplasm, begins to grow with great rapidity, so that the nucellus is soon forced out through the micropyle. Often no megaspore mother-cell can be detected; sometimes a larger cell with shrunken protoplasm and a few nuclei indicates that a mother-cell had begun to germinate, and occasionally when the nucellar growth is not particularly extensive, a normal embryo sac may appear. In both the parents the development of the embryo sac is regular.— CHARLES J. CHAMBERLAIN.

ZACHARIAS has published another paper[14] on the chemistry and structure of the nucleus. The present contribution deals with the contents of the nucleus, exclusive of the nucleus and nuclein-containing structures. Pollen mother-cells of Larix, Iris, Hemerocallis, and other forms were investigated. Material was examined in the living condition and also after treatment with various reagents, but sections do not seem to have been used. In dealing with nuclei in division after the nuclear membrane has broken down, the special term, nuclear cavity (*Kernraum*), is used, because the sphere of influence of the nucleus may not be the same as when the nuclear membrane is still intact. The writer believes that Němec's statement that the spindle fibers consist of plastin is too general. Plastin may be present in some cases, while in others it will be lacking. In the living cell during nuclear division the nuclear cavity, with the exception of the chromosomes, appears as if filled with a homogeneous fluid, in which movable thread-like structures may appear between the separating groups of chromosomes. Zacharias believes that his own investigations, as well as those of morphologists, show that definite spindle fibers have not yet been demonstrated in the living cell, and that it is possible that the structures seen in fixed material may be artifacts.—CHARLES J. CHAMBERLAIN.

[13] TISCHLER, G., Ueber eine merkwürdige Wachsthumserscheinung in den Samenanlagen von *Cytisus Adami* Poir. Ber. Deutsch. Bot. Gesell. **21**: 82–89. *pl. 5*. 1903.

[14] ZACHARIAS, E., Ueber die "achromatischen" Bestandtheile des zellkerns. Ber. Deutsch. Bot. Gesell. **20**: 298–320. *pl. 16*. 1902.

ASTRUC has brought to a conclusion his work on the acidity of plants.[15] He finds that in non-succulents vegetable acids are made chiefly in the young parts; that is, in the particular regions of cellular activity, of maximum turgescence, and of oxidation. These acids are neutralized or etherized little by little, as has already been shown by other observers. These facts serve to explain the distribution of relative acidity in plants, which gradually diminishes as the development of the organs advances. In succulents, on the contrary, the acidity depends upon slight changes in the external conditions, and these make comparisons sometimes difficult. Thus, the free acids in the Crassulaceae present within a single day enormous variation both in formation and in distribution, so that it is quite impossible to lay down any absolute rule for the occurrence of acids in different leaves of even the same plant. From a great number of experiments, however, Astruc has concluded that the formation of greater or less amounts of malic acid during the night depends on photosynthesis during the day, and is intimately related to respiration and to the greater or less value of the internal respiratory ratio during the night. Incidentally he notes a somewhat remarkable fact, that oxygen is not fixed by the cell when the protoplasm is anesthetized by ether or by chloroform. During the day malic acid diminishes in amount under the influence of respiration and photosynthesis, but if the normal conditions for the plant are changed, that is, if there intervene external causes capable of influencing cell activity, these causes will also influence acidity. Thus sectioning of leaves or changing the constituents of the atmosphere enveloping the plant will induce notable changes in the processes of acid formation or destruction.—C. R. B.

THE DEVELOPMENT of the sexual organs and fertilization in *Picea excelsa* are described in a recent article by Miyake.[16] The pollen grain at the time of shedding, about the second week in May, contains two disorganized prothallial cells, a stalk cell, body cell, and tube cell. The tube begins to form a few days after pollination, and the body cell at once passes into it and divides, giving rise to two male nuclei. At this division the beginning of a cell plate appears at the equator of the spindle, but it soon disappears and no wall is formed; consequently the two male nuclei lie free in a common mass of cytoplasm, and there is no formation of two cells, as described by Strasburger, Belajeff, Dixon, and Coulter. The pollen tube does not branch.

The development of the archegonium is very much as in Pinus. In the neck of the archegonium there are 4–8 cells with 2–4 cells in a row. There are usually four archegonia to each ovule, but the number varies from two to seven. During the growth of the egg no passage of nuclear material from

[15] ASTRUC, M. A., Recherches sur l'acidité végétale. Ann. Sci. Nat. Bot. VIII, 17:109. 1903.

[16] MIYAKE, K., On the development of the sexual organs and fertilization in *Picea excelsa*. Ann. Bot. 17: 351–372. *pls. 16–17*. 1903.

the jacket cells into the egg could be detected. The ventral canal cell is formed about a week before fertilization, which, in the neighborhood of Ithaca, occurs about the middle of June. No walls are formed in the proembryo until it has reached the eight-celled stage. Strasburger described walls at the four-celled stage, and other writers have described walls at the four-celled stage in Pinus.

The antheridial cell of Strasburger (third prothallial cell of Belajeff) is called the central cell by Miyake, who regards it as the equivalent of the central cell in the antheridium of pteridophytes. The body cell of Strasburger is called the generative cell. Strasburger refers to the two male cells as generative cells. The terminology is confusing and we are not sure that the present writer has been entirely consistent.—CHARLES J. CHAMBERLAIN.

PLANT HYBRIDS have received but little attention from cytologists. It is known that various species of a genus usually have the same number of chromosomes and that the pollen of sterile hybrids usually have imperfect pollen. Rosenberg[17] has been fortunate in finding a hybrid between parents which differ from each other both in the number and size of their chromosomes. This hybrid is *Drosera rotundifolia* × *longifolia*. *D. rotundifolia* has twenty chromosomes in the sporophyte, this number appearing in the stem, leaf, and root. The chromosomes are short and easy to count. In the pollen mother-cell the number is always ten. In *D. longifolia* the vegetative tissues show forty chromosomes and the pollen mother-cells twenty, just double the numbers in the other species. The chromosomes are also distinguished by being somewhat smaller than in *D. rotundifolia*.

The hybrid is easily recognized by external characters, but is also distinguished by its chromosomes. The mitoses are not different from those of the parents except in the number of chromosomes and the consequent variation in the shape of the spindle. In the sporophyte thirty chromosomes, the sum of the gametophyte numbers of the two parents, was counted in the root, stem, and leaf. In a few cases forty chromosomes appeared in the tapetal cells. In the pollen mother-cells fifteen chromosomes is the dominant number, but twenty often occur, and occasionally mother-cells with ten are found. All three numbers have been found in the same anther. The megaspore mother-cell was not investigated.

The relative number of chromosomes in the parents and hybrid support the theory that the chromosome is a permanent organ of the cell. The fact that three kinds of pollen grains are formed has its bearing upon Mendelism. Professor Rosenberg will continue these investigations.—CHARLES J. CHAMBERLAIN.

IN THE FIRST of a series of studies on the anatomy of ferns, entitled "La masse libéroligneuse élémentaire des Filicinées actuelles et ses princi-

[17] ROSENBERG, O., Das Verhalten der Chromosomen in einer hybriden Pflanze. Ber. Deutsch. Bot. Gesell. 21: 110–119. *pl.* 7. 1903.

paux modes d'agencement dans la fronde," Bertrand and Cornaille[18] describe and discuss, from the taxonomic and anatomical standpoint, the constitution and arrangement of the fibrovascular strands in the leaves of various living orders of ferns. They point out that the petiolar bundle-system of ferns is composed of various combinations of units which they denominate "divergents." Each divergent consists of a protoxylem group placed anteriorly, *i. e.*, toward the upper surface of the frond, and two wings of metaxylem growing out of this posteriorly, *i. e.*, toward the lower surface of the frond. The wood so constituted is typically covered, both dorsally and ventrally, by layers of phloem. The petiolar bundle-systems of the various groups of living ferns may either be gamodivergent, consisting of a number of divergents more or less completely fused together, or dialydivergent, where the divergents are more or less completely separated from each other. In addition the bundle-system as a whole may present various degrees of complexity in the curvatures presented by a line drawn so as to connect all the bundles in a given petiole, etc. The authors point out that there are two striking differences between the petiolar fibrovascular system of the ferns (or Megaphyllides as they term them) and that of the cycads; for in the latter the fibrovascular units corresponding to the divergents, instead of having two wings as in the ferns, are monopolar, and further the protoxylem, instead of being placed anteriorly and toward the upper surface of the leaf is posterior and next the lower surface of the frond, being thus centripetal as in the lycopods. The authors are of the opinion that there should, as a consequence of these differences, be a good deal of reserve in the matter of deriving the cycads from a filicineous stock, as is the almost universal tendency at the present time.— E. C. JEFFREY.

THE formation of the spores in *Rhizopus nigricans* and *Phycomyces nitens* is described by Swingle in a recent *Bulletin*[19] of the Bureau of Plant Industry. Pure cultures were obtained, the material was fixed, sectioned, and stained, according to the most approved cytological methods. The paper deals especially with the mechanics of the peculiar cell division found in these sporangia, and with the nature and functions of the vacuole. It is of interest to note that the four genera of the Mucorineae which have now been carefully investigated, Pilobolus and Sporodinia studied by Harper, and Rhizopus and Phycomyces studied by the present writer, differ considerably in the formation of their spores. The following is Swingle's own summary of the process:

[18] BERTRAND, C. E., and CORNAILLE, F., Etude de quelques caractéristiques de la structure des Filicinées actuelles. Travaux et Mémoires de l'Université de Lille 10: —. 1902.

[19] SWINGLE, DEANE B., The formation of spores in the sporangia of *Rhizopus nigricans* and *Phycomyces nitens*. U. S. Dept. of Agric., Bureau of Plant Industry. Bull. 57. pp. 40, *pls.* 6. 1903.

1. Streaming of the cytoplasm, nuclei, and vacuoles up the sporangiophore and out toward the periphery, forming a dense layer next the sporangium wall and a less dense region in the interior, both containing nuclei.

2. Formation of a layer of comparatively large, round vacuoles in the denser plasm, parallel to its inner surface.

3. Extension of these vacuoles by flattening, so that they fuse to form a curved cleft in the denser plasm; and, in the case of Rhizopus, the cutting upward of a circular surface furrow from the base of the sporangium to meet the cleft formed by these vacuoles, thus cleaving out the columella.

4. Division of the spore-plasm into spores; in Rhizopus. by furrows pushing progressively inward from the surface and outward from the columella cleft, both systems branching, curving, and intersecting to form multinucleated bits of protoplasm, surrounded only by plasma-membranes and separated by spaces filled with cell sap only; in Phycomyces, by angles forming in certain vacuoles containing a stainable substance and continuing outward into the spore-plasm as furrows, aided by other furrows from the columella cleft and dividing the protoplasm into bits homologous with and similar to those in Rhizopus, and separated by furrows partly filled with the contents of the vacuoles that assist in the cleavage.

5. Formation of walls about the spores and columella, and, in the case of Rhizopus, the secretion of an intersporal slime.

6. Partial disintregration of the nuclei in the columella.—CHARLES J. CHAMBERLAIN.

AN EXCELLENT ACCOUNT of the sexual processes in *Plasmopara alpina* Johans. by Rosenberg[20] adds another form to the list of Phycomycetes which are now receiving so much attention.

Plasmopara conforms in all essentials to the condition in Peronospora and Albugo. The oogonium contains at first about forty-five nuclei, which number is doubled by the first mitosis. All of these pass into the periplasm excepting one, which remains in the ooplasm near a coenocentrum. There is then a second mitosis, affecting almost all of the nuclei. The nucleus in the ooplasm divides, forming the female nucleus, which remains close to the coenocentrum, and a sister nucleus that passes to one side and breaks down. Thus proximity to the favorable conditions around the coenocentrum determines the selection of the functional gamete nucleus here as in others of the Peronosporales and in the Saprolegniales.

The antheridium contains at first about five nuclei, which are increased to ten or twelve by mitosis. One male nucleus is introduced into the egg and fuses with the female.

Of especial interest are Rosenberg's views on the significance of the mitosis in the oogonium and antheridium. The author considers these as

[20] ROSENBERG, O., Ueber die Befruchtung von *Plasmopara alpina*. Bih. Svensk. Vet.-Akad. Handl. **28**:—. [1–20. *pls.* 2.] 1903.

comparable to the tetrad divisions in higher plants, meaning the two mitoses in the spore mother-cell. The nucleus passes through a synapsis condition before the first mitosis. The spindle is intranuclear with small granular bodies at the poles as in others of the Peronosporales. In the second mitosis the spindle is less distinct, as Stevens noted in Albugo. The number of chromosomes appears to be about the same in each mitosis. Rosenberg regards the synapsis as indicating a reduction of the chromosomes, in agreement with the generally accepted history of the spore mother-cell, and considers its presence in relation to the two mitoses as establishing analogies with these events.

The reviewer has recently discussed the behavior of the nucleus during gametogenesis in the Phycomycetes[21] and regrets that he could not have included Rosenberg's views in that account. However, his opinions are not changed by these results. It is not established that synapsis has any relation to reduction phenomena in the thallophytes, and it is also being reported among higher plants in tissues where there is no reduction. The number of mitoses in the gametangia of Phycomycetes is quite variable. There is only one in the oogonium of Saprolegnia and in certain species of Peronospora and Pythium. This mitosis is probably a phylogenetic reminiscence of times when many gametes were formed in these gametangia. A second mitosis is probably merely a continuation of the tendency to multiply the nuclei and would be carried farther if nutritive conditions allowed. The second mitosis is more likely to be found in the ooplasm, because that portion of the cell is unquestionably better nourished, which explains its entire or partial absence in the periplasm. There is excellent evidence that the second mitosis is weaker in kinoplasmic material than the first, thus showing the effect of unfavorable conditions in the cell.

This is not saying that reduction phenomena may not take place just previous to the mitoses in the gametangia of Phycomycetes, but comparisons between these mitoses and the events in the spore mother-cell are not likely to have much value in establishing the supposition. To the reviewer the probabilities seem all against the existence of reduction phenomena previous to gametogenesis in plants, for it is more natural to expect it either immediately after the sexual act or at the end of a sporophyte generation. The proof must come through studies of the nucleus at various periods of ontogeny and the evidence will accumulate slowly. We do not know of any better forms for such investigations than some of the Peronosporales, unless they be certain Chlorophyceae which have not received their fair share of attention in the cell studies of recent years.— B. M. DAVIS.

ROTHERT has studied the effects of ether and chloroform on the sensibility of microorganisms.[22] Knowing that narcotics affect the various functions of

[21] DAVIS, B. M., Oogenesis in Saprolegnia. BOT. GAZ. **35**: 339–342. 1903.

[22] ROTHERT, W., Ueber die Wirkung des Aethers und Chloroforms auf die Reizbewegungen der Mikroorganismen. Jahrb. Wiss. Bot. **39**: 1–70. 1903. The title is

higher animals differently according to the concentration and duration of action, so that the effects can be arranged in a graded series, he proposed to himself the solution of the question whether a similar gradation in narcosis existed among plants and the protozoa, in which the differentiation and division of labor has not gone so far. If, for example, their sensitiveness to external stimuli could be suspended more easily than other vital phenomena, it would be possible by partial narcosis to make them insensitive (*i. e.*, to produce anesthesia), without at the same time suppressing those functions (growth, movement, etc.) by means of which a visible reaction could be executed. Thus an important means of analyzing irritable reactions might be secured.

After securing suitable material (a matter of great difficulty), tests were made (1) by putting organisms into vials containing water with known percentages of the narcotic, with precautions against its evaporation; (2) by using mounted preparations, the cover being supported, in which were introduced Pfeffer's capillary tubes (for chemotaxis) or air bubbles (for aerotaxis); or (3) by means of hanging drop cultures in a moist chamber. The criterion for the existence of sensibility was the accumulation of the individuals in definite regions.

Naturally, though not the chief aim, many observations were made on the effect of narcotics on motility. The resistance of nearly related organisms is very different; *e. g.*, one form of *Bacterium termo* ceased to move in 20 per cent. ether-water,[23] while many individuals of another form, apparently the same species, resisted a saturated solution of ether for five hours. Similarly *Gonium pectorale* has its movements slowed by 2.5 per cent. ether-water and wholly stopped by 20 per cent.; whereas *Chlamydomonas sp.?* moved normally in 20 per cent. ether-water and was only stopped by 60 per cent. Individual differences are also noticeable.

Rothert found various forms in which the osmotactic, chemotactic, aerotactic, or phototactic sensitiveness could be suspended by the narcotics, while movement was not. Thus in one form of *B. termo*, chemotaxis and aerotaxis were only slightly reduced by moderate concentrations, while osmotaxis was completely checked. In *Bacillus Solmsii* chemotactic sensibility was stopped by chloroform but not by ether.

A curious reversal of phototactic reaction occurred with chloroform, both in Chlamydomonas, which cannot be anesthetized, and in Gonium, which is easily made insensible. These organisms, which were reacting negatively,

inappropriate to the paper, for Rothert specifically says (p. 15): "The question as to the influence of narcotics upon the motility of microorganisms I did not consider the object of my investigations." Nor are the researches confined to "microorganisms," as this term is commonly used, though all the forms studied were microscopic.

[23] *I. e.*, a 20 per cent. solution of a saturated solution of ether in water at room temperature; similarly designated in other cases.

immediately upon treatment with weak chloroform-water reacted positively. In other words, the critical intensity of light (*i. e.*, the point at which a given organism will not react) was raised by the chloroform, so that what they fled from before, they now sought. This effect disappears gradually, and the faster the weaker the chloroform. Ether produces no such effect. Immediately after a phototactic organism recovers from a dose of ether or chloroform, its reaction is always negative. If normally positive, the reaction is reversed; if normally negative, the reaction is intensified; *i. e.*, the critical intensity of light is lowered.

The results reached by Rothert regarding the specifically different susceptibility of related forms to narcosis are quite irreconcilable with the statements of Overton, who holds[24] that this susceptibility depends on the grade of differentiation of the cells, as indicated by the rank of the organism. Even individual differences were found by Rothert to be great.

It is found to be characteristic of the anesthetic effect of ether and chloroform on microorganisms that it depends only upon their concentration and not upon the duration of their action. Anesthesia appears instantly and disappears as quickly. No solution which is too weak to effect anesthesia at once will produce it by prolonged action. Some observations indicate that solutions too weak to produce complete anesthesia will diminish the degree of sensitiveness to stimuli. The effect of these narcotics on movement, however, is quite different; for this depends both on their concentration and the duration of their action.

This paper adds valuable data to our present knowledge of the narcosis in plants, for which previously we have been chiefly indebted to Overton.—C. R. B.

[24] Studien über die Narkose. Jena. 1901.